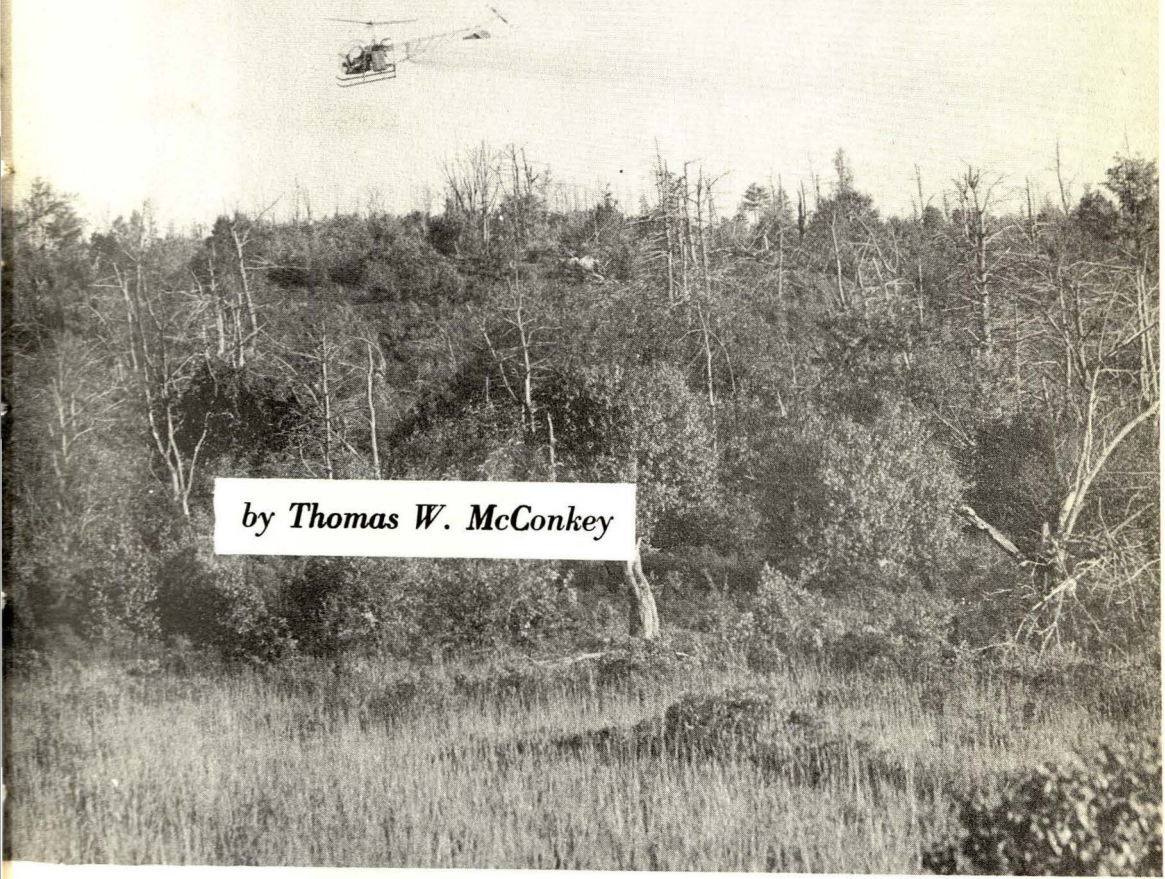
Helicopter Spraying

with 2,4,5-T

to release young white pines



by Thomas W. McConkey

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THOMAS W. McCONKEY *took his Bachelor's and Master's degrees in forestry at Cornell University in 1933 and joined the U.S. Forest Service the same year. His work has been almost entirely in the fields of forest management and silviculture. His interest in white pine silviculture dates from 1947, when the Northeastern Forest Experiment Station assigned him as forester in charge of its Massabesic Experimental Forest at Alfred, Maine.*

Helicopter Spraying

with 2,4,5-T to release young white pines

by

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Preparing the helicopter for spraying operation. Use of this photo and the one on the cover was made possible through courtesy of Scott Hoar, of Sanford, Maine.

WHEN FOREST FIRES swept over southwestern Maine in 1947, some 130,000 acres of forest land were burned over. This was mostly white pine land--sites too poor to grow good hardwood stands. After the fire, white pine reproduction became established on 5,000 to 6,000 acres of this land (3). But by 1954 most of the young pine was suppressed or at least was in competition with hardwood sprout growth and brush species.

Most of the Massabesic Experimental Forest was in the burned area. Here too, adequate white pine reproduction for a new stand had become established--on some 500 acres of the Forest. Most of it had to compete with hardwood growth. Prospects for a new stand of white pine were poor unless the young pines were released.

Fisher (6), Cline (4), and others have shown that, if white pine seedlings are to survive, overtopping hardwood competition must be eliminated. Cutting back the hardwoods to get this release is expensive. As many as four treatments (a total of 2 man-days per acre) over a 10-year period may be needed (4, 6, 7). However, hardwoods have been controlled successfully with airplane spraying of 2,4,5-T in the Lake States, the far West, and by helicopter on power line rights-of-way in the Northeast (2, 5, 1).

At the suggestion of A. D. Nutting, Maine Forest Service Commissioner, experimental aerial applications of spray to release white pine were undertaken on the Massabesic Experimental Forest.

Release Work Begun

Release work was begun on the Massabesic Forest in 1954, using as a guide the methods of aerial application that had been developed in the Lake States. Helicopter spraying was decided upon (rather than use of a fixed-wing airplane) because the low flying speed of the helicopter and the downdraft from its rotors make the helicopter well suited for this kind of work.

Two areas were treated, one of 15 acres and the other of 30 acres. They are less than ¼ mile apart and were typical of the burned land, with white pine reproduction in competition with low-value hardwoods. The hardwoods were white oak, northern red oak, black oak, and red maple sprout clumps, and white birch, gray birch, aspen, and pin cherry seedlings. They were generally 5 to 10 feet tall. Sweet fern was present throughout most of both areas.

The 15-acre area had the denser and more thrifty stand of new growth--up to 45,000 hardwood stems per acre. The stand on the 30-acre area was not so dense or thrifty--about 30,000 stems per acre. Some overstory trees on both areas had survived the 1947 fire, among them an occasional pine. There were enough hardwood trees (mostly oak) on the smaller area to intercept an appreciable amount of the spray applied. Interception by the few trees on the larger area was not important. White pine reproduction and a few balsam fir, generally less than 2 feet tall, were well distributed over both areas.

The areas were treated on July 14 with a helicopter equipped for general spray work. An application of 1-pound acid equivalent of 2,4,5-T per acre was made on the smaller area. This rate had been found adequate in the Lake States.

A much heavier application--3 pounds acid equivalent per acre--was made on the larger area. This was done to see if there would be any appreciable difference in extent of hardwood control and to see if young white pines would be damaged seriously by stronger applications. Fuel oil was used as the carrier. On both areas the volume of chemical plus oil was 2½ gallons per acre.

The helicopter flew at 50 miles an hour. Rate of delivery was 10 gallons per minute at a pressure of 50 pounds per square inch. It was necessary to fly about 60 feet above the ground to clear the taller trees. Strips were flown at 50-foot intervals to assure coverage. There was a 5- to 10-mile-an-hour wind blowing when the application was made. Resulting drift killed hardwoods for 200 yards on the leeward side of the sprayed areas. In one instance, birch trees ¼ mile away were killed.

Table 1.--Per-acre cost comparisons for helicopter applications of 2,4,5-T

Item	1954	1956
	Dollars	Dollars
3 pounds 2,4,5-T acid equivalent	5.35*	5.35
1-3/4 gallons of fuel oil	.23	.25
Application (helicopter rental)**	3.67	3.73
Marking boundaries	2.75	1.02
Misc. (travel, supervision, etc.)	2.05	.45
Total	14.05	10.80

*1956 price of silvicide. Actual cost in 1954 was $8.15.

**A "job price" was charged for these applications. On project work, helicopter rental would be based on a rate per gallon applied. Cost in the Lake States with fixed-wing aircraft has ranged from 80 cents to 2 dollars an acre (4).

(Drift damage extended less than 50 yards when a similar application was made on a calm day in 1955. Additional spraying has been done every year since 1954, but only results of the 1954 treatment are reported here.)

The cost was $14.05 per acre for the 3-pound application and $10.60 for the 1-pound application of silvicides. About $3 or $4 of this can be charged to inexperience and unnecessary work performed. A 3-pound application in 1956 cost $10.80 per acre (table 1).

Effect on Hardwoods

A preliminary appraisal of the treatments was made in September 1954, 6 weeks after treatment. Where the 1-pound application had been made, there was only a fair kill of birch and aspen leaves; oak and maple showed only a partial browning of the most exposed foliage; and sweet fern appeared to be slightly damaged. Where the 3-pound rate had been used, nearly all birch and aspen leaves were dead; some of the foliage had turned color on oak and maple; and sweet fern appeared to be severely damaged. On both areas, leaf kill was less in places where the young growth was shielded by trees in the overstory.

Another examination was made in November, about 4 months after treatment. Little change was observed on the area treated with the 1-pound rate: some birch twigs were dead. On the area treated at the 3-pound rate, there were increasing signs of kill. There was a good top-kill of birch, but the stems were still green at the root collar. Buds and twigs were dead on sweet fern, on many of the oaks, and on upper portions of the red maple.

In the fall of 1955 a careful examination was made on both areas. A tally was made of all birch and sweet fern on sample milacres--12 milacres on the area treated at the 3-pound rate and 8 on the area treated at the 1-pound rate. The ten oak and red maple sprout clumps nearest each milacre were examined to estimate extent of kill for these species.

On the area treated at the 1-pound rate, there was a reasonably good kill of birch and white oak. Only a few red oaks were killed, and red maples were only slightly damaged. About one third of the sweet fern had been killed and the rest damaged; but new root suckers had increased the total number alive (table 2).

On the area treated at the 3-pound rate, practically all the birch and sweet fern had been killed back; but the sweet fern stems killed were more than replaced by root suckers. The tops of practically all the white oaks were killed and so were 70 percent of the red oaks; but only a

Table 2.--Effect on hardwoods of 1-pound-per-acre application of 2,4,5-T, end of 1955 growing season

Degree of understory kill	Birch (427)*	White oak (28)*	Red oak (63)*	Red maple (90)*
	Percent	Percent	Percent	Percent
Killed, no new sprouts	64	57	13	--
Top-killed; new sprouts	29	18	9	7
Crowns more than 3/4 dead	7	21	26	--
Crowns 1/2 to 3/4 dead	--	--	9	--
Crowns less than 1/2 dead	--	4	43	93

*Basis: number of trees (birches) or sprout clumps (oaks and red maple) examined. Sprout clumps consisted of 2 to 5 or more stems per clump, dating from 1948. The extent of kill was tallied as that of the greenest stem in the fall of 1955.

Overstory oaks--potential wolf trees--were nearly dead 1 year after application of 3 pounds acid equivalent per acre. One year later there was no living foliage on these trees. Understory hardwoods were completely killed. White pines remain undamaged.

Table 3.--Effect on hardwoods of 3-pound-per-acre application of 2,4,5-T, end of 1955 growing season

Degree of understory kill	Birch (378)*	White oak (20)*	Red oak (100)*	Red maple (120)*
	Percent	Percent	Percent	Percent
Killed; no new sprouts	70	90	37	2
Top-killed; new sprouts	30	5	34	5
Crowns more than 3/4 dead	--	--	16	9
Crowns 1/2 to 3/4 dead	--	--	2	3
Crowns less than 1/2 dead	--	5	11	81

*Basis: number of trees (birches) or sprout clumps (oaks and red maple) examined. Sprout clumps consisted of 2 to 5 or more stems per clump, dating from 1948. The extent of kill was tallied as that of the greenest stem in the fall of 1955.

few of the red maple tops were killed (table 3). (Yet a 3-pound application on another area in 1955 resulted in a nearly complete kill of red maple.)

On both areas, the crowns of the overstory hardwoods (mostly oaks) were almost dead. However, some new growth was developing along the main stems and larger branches.

There was considerable variation in extent of kill among the sprout clumps on both areas. Some had only a few green leaves, while others were more than three-fourths green.

In order to see if additional sprout clumps died, 12 clumps of red maple and 13 of oak were tagged on the area treated at the 3-pound rate. These were examined again in the fall of 1956. Red maple sprout clumps showed little change; apparently they will recover. A few more oak clumps were dead. Half of those that had had about one-tenth of

their tops green in the fall of 1955 were dead; most of those that had had more than two-tenths of their tops green seemed to be recovering.

Effect on White Pine

In the 1954 examinations, terminals on about one-fifth of the white pine seedlings showed some injury on the area treated at the 3-pound rate. No damage to pine was apparent on the other area.

To trace the effect of the treatments on the pines, and their response to release, 82 pines were tagged in the fall of 1954 on the area where 3 pounds of 2,4,5-T per acre were used. In 1955, 44 pines were tagged on the area where 1-pound per acre was applied.

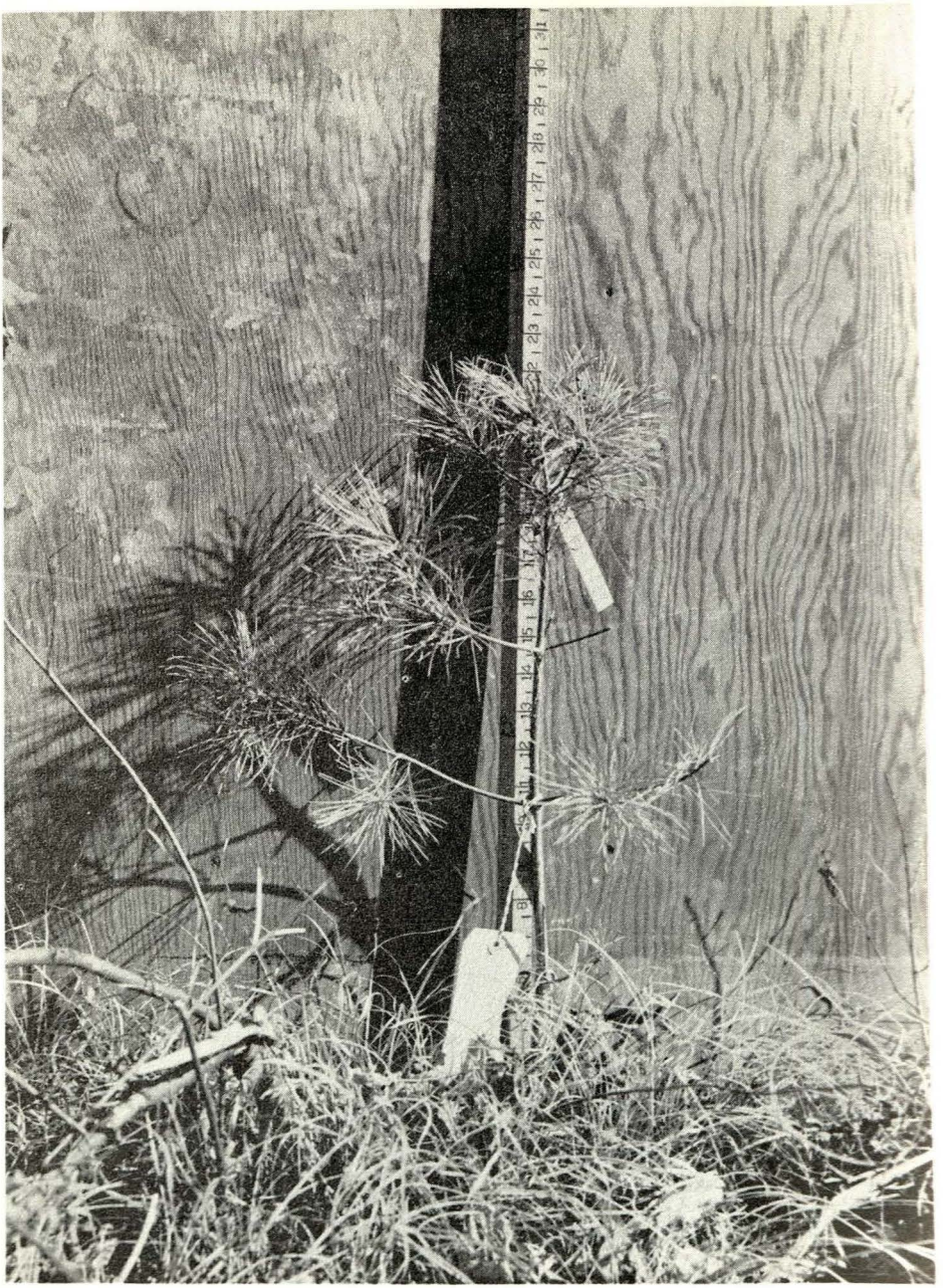
In the fall of 1955, none of the pine seedlings tagged was dead, though the 1954 terminals of seven young pines on the area treated with the stronger dose of 2,4,5-T had been distorted or killed. There were no damaged pines on the other area. The damaged pines were recovering in 1955: there was new growth on the distorted terminals, and lateral branches had replaced dead terminals.

Table 4.—Comparison of growth between untreated and released pines

Growth	1-pound application				3-pound application			
	Untreated		Released		Untreated		Released	
	1955	1956	1955	1956	1955	1956	1955	1956
	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches
Terminal length	9.7	6.2	8.5	12.2	5.1	4.8	5.9	6.5
Terminal diameter	.17	.14	.22	.25	.13	.13	.18	.20
Diameter, base of tree	.49	.56	.57	.79	.33	.39	.47	.63
Diameter increase, base of tree	--	.07	--	.22	*.07	.06	*.16	.16

*Increase from 1954 to 1955.

Released by application of 3 pounds acid equivalent of 2,4, 5-T per acre, this white pine has grown 15 inches in the 2 years since release. Volume of foliage and thickness of terminal indicate that this tree will continue to respond to the release.



This white pine, which was not released, has grown only 7 inches in the last 2 years. There is nothing in its appearance to indicate that better growth can be expected of it in the future.

Where 3 pounds acid equivalent of 2,4,5-T per acre was used, red oak sprout growth no longer competes with white pine reproduction. Two-year-old oak sprouts are still affected by the silvicide but the pines are already growing more than twice as fast as they did before release.

All pine showed response to release, particularly by increased diameter growth at the base, in 1955. The 1956 examination showed that the pines were continuing to respond to release on both areas. They were growing about three times as much in diameter at the base as unreleased pines, and were making appreciably better terminal growth (table 4).

The overstory pines were not damaged by the spray treatments.

At present there is little possibility that the hardwoods (except for occasional clumps of red maple sprouts) will again seriously compete with the established pines on the area treated at the 3-pound rate. Birches and nearly all oaks are dead. Where new sprouts have appeared, carry-over effects of the treatment are evident in bud mortality and retarded growth. Many of the young pines, formerly growing under hardwoods, are twice as tall as when they were released. On the area treated at the rate of 1 pound per acre, the hardwoods may recover to again compete with the pine. At present the pines on this area (where all growth has generally been better) are growing faster than on the area treated at the 3-pound rate.

Summary and Discussion

A helicopter application of 2,4,5-T was made on two areas of the Massabesic Experimental Forest in 1954. Rates of 1 and 3 pounds acid equivalent in enough fuel oil to total 2½ gallons per acre were used.

Both rates of application killed the hardwood overstory (mostly oak). Results of the treatment indicate that birch and white oak can be controlled readily with such

treatments; that fair control of red oak can be expected; that although red maple can be severely damaged, it is rarely killed; and that sweet fern is readily killed but new root suckers replace the original growth.

Effects on white pine were beneficial. White pine is relatively resistant to 2,4,5-T, and the occasional damaged young tree recovers. White pine shows a good response to release after hardwoods are controlled by these treatments.

It is not possible to make good comparisons between 1- and 3-pound applications of 2,4,5-T per acre because of the differences between the stands on the two areas treated. There were more overstory trees, and a much denser understory, on the area treated at the 1-pound-per acre rate. An occasional overstory tree does not seem important, as there is usually enough drift to assure good coverage of leaf surfaces under it. But on areas that have a moderately dense upper canopy, too little spray material reaches the understory to assure adequate leaf coverage and kill.

On the area treated at the 3-pound rate the overstory was rather sparse and appreciably more of the understory was killed. A poorer kill on the area treated at the 1-pound rate can be at least partly accounted for by the more dense overstory.

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